United States Department of Agriculture
Agricultural Research Service

EASTERN REGIONAL RESEARCH CENTER FACT SHEET

Effect of Interventions and Processes on Persistence of Pathogens on Foods

Program Background

Our research program is focused on identifying where potentially pathogenic bacteria enter the food supply, determining how pathogens persist, and developing methods to eliminate or control pathogens in foods. The pathogens we study include *Listeria monocytogenes*, *Salmonella*, *Escherichia coli* O157:H7, and *Bacillus anthracis*, while the foods we study include ready-to-eat meats, poultry products, fluid milk, and Hispanic-style cheeses. We are working to identify the sources of these pathogens in foods and in food processing environments, and to determine the genes and proteins that are responsible for pathogen survival and persistence. DNA fingerprinting is used to identify pathogens from sources between the farm and retail distribution to determine where pathogens persist. Processes and interventions, such as fermentation, micro filtration, high pressure processing, food grade chemicals, and heating, alone or in combination, are evaluated for their ability to inhibit or remove undesirable bacteria and to better manage pathogen presence and/or survival during manufacture and storage. The research results are needed to assist manufacturers in meeting current regulatory guidelines and to assist regulators in science-based policy decisions. Using the tools of genomics and proteomics, we are working to identify the genes and proteins necessary for pathogens to survive in food-related environments and that are responsible for human food-borne illnesses. These studies help us understand significant food borne pathogens and bioterrorism threat agents, and will lead to better methods for controlling these organisms in foods prior to human contact and consumption. Ultimately this enhances the safety and security of our food supply.

Research Objectives

The overall objective is to reduce the occurrence, risk, and severity of human illness resulting from the consumption of foods contaminated with pathogenic microorganisms. The project focuses on the following three main objectives aimed at increasing our understanding of pathogen persistence in foods and in turn developing and evaluating effective interventions to enhance the safety and security of our Nation's food supply:

- Determine the ecology of pathogens in various foods with specific focus on foods considered high risk by food industry regulators like the Food Safety Inspection Service and the Food and Drug Administration. Example foods include ready-to-eat foods, or foods with a short shelf life.
- Develop and validate intervention strategies to be used alone or in combination with other processes for pathogen control.
- Determine the pathogens' physiological responses to various intervention strategies, food processes, and to the inherent food production macro and microenvironments.

Impact

The research on molecular characterization of pathogens and threat agents using such techniques as DNA sequencing and analysis of genetic mutants provides important information regarding the underlying genetic basis for addressing why certain strains or serotypes are more prominent in food borne outbreaks and why certain strains or serotypes survive better within different foods and in the processing environment.

DNA fingerprinting methods are applied throughout the farm-to-table chain to determine entry points, incidence and persistence of pathogens on higher-risk foods. This research will also update information on the types and subtypes of pathogens on foods and result in use of relevant strains in intervention studies.

Finally, this research evaluates the efficacy of processing methods and interventions on pathogen persistence. This aspect of the research can have immediate impact by identifying new approaches for reducing pathogen levels on higher-risk foods. Some examples are:

- Inclusion of potassium lactate as an ingredient in packages of frankfurters is sufficient to prevent outgrowth of the pathogen *Listeria monocytogenes* during 90 days of refrigerated storage. This finding had immediate impact since manufacturers using potassium lactate as an ingredient could satisfy "Alternative 2" of the latest USDA FSIS policy by preventing outgrowth of this pathogen and, as such, are not subjected as frequently to regulatory sampling.

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• Pasteurization of milk does not inactivate spores of the threat agent *Bacillus. anthracis*. In collaboration with the Dairy Processing and Products Research Unit, new technologies are being developed that remove spores and pathogenic bacteria from milk while maintaining the quality and nutritional profile of milk. The technologies are validated at a scale that is relevant to commercial operation and are designed to fit into existing fluid milk processing lines to minimize capital and operating costs. Prefatory experiments demonstrated removal of 99.9999% of *B. anthracis* spores from a skim milk stream. This research will have immediate impact as a new approach for improving the security of the milk supply.

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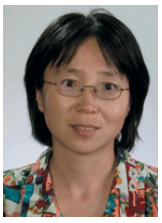

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